Atlantic Richfield Company

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February 6, 2017

Gary Riley
Lynda Deschambault
Remedial Project Manager, Superfund Division
U.S. Environmental Protection Agency, Region 9
75 Hawthorne Street, 10th Floor (SFD 7-1)
San Francisco, California 94105

Subject: Interim Combined Acid Drainage Treatability Investigation Report Response to Comments
Leviathan Mine Site
Alpine County, California

Dear Mr. Riley and Ms. Deschambault:

Atlantic Richfield Company (Atlantic Richfield) submits this letter in response to comments provided by the U.S. Environmental Protection Agency (U.S. EPA) dated December 21, 2016 regarding the Interim Combined Acid Drainage Treatability Investigation Report, dated December 18, 2015. The subject Report was submitted in partial fulfillment of the requirements of the Statement of Work attached to the Administrative Order for Remedial Investigation and Feasibility Study (Unilateral Administrative Order), Comprehensive Environmental Response, Compensation, and Liability Act Docket No. 2008-18 issued by the U.S. Environmental Protection Agency on June 23, 2008.

Enclosed are Atlantic Richfield's responses to U.S. EPA comments (Table 1).

If you have any questions or comments, please feel free to contact me at (714) 228-6770 or anthony.brown@bp.com.

Sincerely,

Anthony R. Brown
Project Manager, Mining

Attachments:
Table 1 – Response to U.S. EPA Comments Dated December 21, 2016

cc: Brian Johnson, Atlantic Richfield – via electronic copy
John Hillenbrand, U.S. Environmental Protection Agency, Region 9 – via electronic copy
Douglas Carey, Lahontan Regional Water Quality Control Board – via electronic copy
Nathan Block, Esq., BP – via electronic copy
Adam Cohen, Esq., Davis Graham & Stubbs, LLP – via electronic copy
Sandy Riese, EnSci, Inc. – via electronic copy
Marc Lombardi, Amec Foster Wheeler Environment & Infrastructure, Inc. – via electronic copy
Craig Weber, Amec Foster Wheeler Environment & Infrastructure, Inc. – via electronic copy
Grant Ohland, Ohland HydroGeo, LLC – via electronic copy
Dave McCarthy, Copper Environmental Consulting – via electronic copy
Jeremy Boucher, Broadbent & Associates, Inc. – via electronic copy
Cory Koger, U.S. Army Corps of Engineers – via electronic copy
Greg Reller, Burleson Consulting – via electronic copy
Michelle Hochrein, Washoe Tribe of California and Nevada – via electronic copy
Fred Kirschner, AESE, Inc. – via electronic copy

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TABLE 1
RESPONSE TO U.S. EPA COMMENTS DATED DECEMBER 21, 2016
Leviathan Mine Site
Alpine County, California

Comment #	U.S. EPA General Comments on Atlantic Richfield Company's Interim Combined Acid Drainage Treatability Investigation Report, Leviathan Mine Site, Alpine County, California, Dated December 18, 2015	Response
G1	**Treatability Vs. Final Design:** ARC's ICT Report states that *"Treatability testing was not conducted to determine the feasibility of using the current HDS Treatment System and ponds under all potential treatment conditions that may be evaluated in selecting the final preferred remedial alternative for the site"* (Page 7, Section 3.0 Objectives, first paragraph). Based on this statement, EPA considers the ICT report as describing studies undertaken to determine if the ongoing early response actions (ERA) could be modified so that combined influent originating at the Adit, PUD, CUD, and DS could be successfully treated using the existing high density sludge (HDS) plant at Pond 4 during typical treatment season flow and chemistry conditions. Any proposed modifications to the current early response action systems must explicitly address concerns regarding system sizing and contingency for wet years such as those that occurred during 2004-2005, 2005-2006, and 2010-2011. These concerns are outlined in greater detail in the specific comments below. For purposes of completing the Feasibility Study, ARC shall ensure that the information summarized in the ICT report and any necessary information resulting from implementation of ICT is completed in time, and used to inform the FS in support of evaluating final remedies.	Atlantic Richfield will use the information summarized in the Interim Combined Acid Drainage Treatability Investigation Report (ICT Report) to: (1) inform the Feasibility Study (FS) in support of evaluating final remedies, and (2) evaluate the High Density Sludge (HDS) Treatment Plant's ability to perform interim combined treatment (ICT) under *"conditions reasonably anticipated to occur during the interim, pre-remedy period."* This approach is in line with the stated objectives of the Interim Combined Acid Drainage Treatability Investigation Work Plan (ICT Work Plan), which include: (1) evaluation of the effectiveness and efficiency of HDS treatment technology to treat the primary acid drainage (AD) discharges, and (2) evaluation of the adequacy and sizing of the HDS Treatment System to handle flows from the combined AD discharges under reasonably anticipated discharge rate scenarios. The ICT Work Plan defines the upper estimate for reasonably anticipated discharge rate scenarios as the 85th percentile water year. During the FS, "wetter" years (increased flows and potentially more concentrated water chemistry) will be further evaluated; however, they will be evaluated in conjunction with other potential remedial alternatives that may affect the treatment system flow rates, storage capacities, and water chemistry. Source water reduction (e.g., regrading, revegetation, cut-off walls, etc.), longer treatment periods or year round treatment, and increased pond capacity are among some of the potential remedial alternatives which may alleviate HDS Treatment Plant sizing concerns for treating water beyond the 85th percentile water year and/or eliminate the need for early season treatment altogether. The ICT Report summarizes the results of a focused feasibility study evaluating the suitability of existing infrastructure and equipment for effective treatment of combined AD flows under prescribed conditions. While this study will provide important information for the screening of remedial alternatives in the FS, it was not intended, by itself, to serve as the basis for a final remedial action decision or to demonstrate that the HDS Treatment Plant, as currently configured, can effectively treat all AD collected at the site. As presented in the ICT report, Atlantic Richfield plans to perform a full-scale ICT field demonstration (ICT Demonstration) in 2017 to gather additional field data and fully evaluate the feasibility and effectiveness of combined treatment using the HDS Treatment Plant under reasonably anticipated flow scenarios. Following completion of the ICT Demonstration, Atlantic Richfield plans to prepare and submit to the U.S. EPA an ICT Demonstration Summary Memorandum documenting the ICT Demonstration activities, results, and proposed schedule for subsequent full-scale ICT activities. The results from the ICT Demonstration and any subsequent full-scale ICT activities will also be used to inform the FS in support of evaluating final remedies. With respect to evaluating the HDS Treatment Plant's ability to perform ICT during the interim, pre-remedy period, which is anticipated to be less than 15 years, the 85th percentile water year was selected as the upper estimate for evaluating the HDS Treatment Plant capacity. Evaluating and performing design modifications to the HDS Treatment Plant to meet the peak flow rates of outlier "wet" year scenarios beyond the 85th percentile year, which may only occur for a short period of time once or twice every decade, could be costly and lead to inefficient plant operations (e.g., operatng oversized equipment) for the majority of the operating period. As stated in the ICT Report, to address situations where additional treatment capacity is needed (e.g., flows greater than the reasonably anticipated flows, lower than anticipated HDS Treatment Plant capacity or availability, or early season treatment in heavy precipitation years), other contingency treatment system(s) would be employed on-site as needed to meet the additional demand. During those outlier scenarios in the past, an emergency early season (April/May) temporary treatment system (i.e., Rotating Cylinder Treatment System [RCTS]) has been successfully employed at the site (2004-05, 2005-06, 2010-11) by the Lahontan Regional Water Quality Control Board (LRWQCB) to prevent untreated discharges from Ponds 1 and 2N/2S (Upper Ponds). The RCTS or similar early season contingency treatment systems would be employed again in the future to maintain compliance with the Early Response Action (ERA) interim orders (Administrative Abatement Action [AAA] and Administrative Order on Consent [AOC]).

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		In addition, the HDS Treatment Plant will also be available to provide supplemental early season/wet year treatment capacity. This is an improvement to current operations where the Pond Water Treatment System is not available during early season treatment to treat AD, and the RCTS has been the sole method for treating early season AD. Having the HDS Treatment Plant available for treating water conveyed from the Upper Ponds via the newly constructed conveyance system will further mitigate the risk of discharging AD during early season/wet year scenarios.
G2	(see comment below)	(see response below)

Comment G2 (U.S. EPA):

Actual Site Conditions and Full Analysis of the Capacity to Treat Expected Influent Water. Please provide a full analysis of the typical spring season influent water expected at the site. EPA has prepared Table 1 below to compare the data assumptions for expected acidity, dissolved total iron, ferrous iron, and sulfate concentrations. The table compares the concentrations of acid drainage treated from the upper ponds during 2006 to the concentrations in Phase IIA, Phase IIB, and the proposed 85th percentile shortened season. The comparison shows that the upper ponds contain significantly more acidity, total iron, ferrous iron, and sulfate than the water ARC has evaluated in the ICT report.

Table 1: Comparison of expected chemical conditions

	Phase IIA[4]	Phase IIB[6]	85^{th} shortened[1]	May 2006[7]
Acidity	3,300	3,800	2,900	5,000
Dissolved total Fe (mg/L)	650	490	610	1,100
Ferrous Fe (mg/L)	2[5]	20	480	900
Sulfate (mg/L)	5,000	5,300	3,300	6,380
Influent Flow (gpm)	NA	NA	143	111[2]
Sludge Recycle rate (gpm)	NA	NA	35	27[3]
Total Flow within HDS Plant	NA	NA	178	138

Notes:
1 = Table 6 of ARC's ICT report; dated December 18, 2015; calculated by ARC; per an 85 th percentile water year.
2 = Average flow rate necessary to prevent pond overflow during 2011 Spring season
3 = Estimated from values in Table 7 of ARC's ICT report; dated December 18, 2015
4 = From Table 5 of ARC's ICT report; dated December 18, 2016. This is the one was abandoned; required too much lime.
5 = From Table 5 of Attachment C of ARC's ICT report; dated December 18, 2015
6 = From Table 11 of Attachment C of ARC's ICT report; dated December 18, 2015; more dilute
7 = May 2006 data are from Appendix C of the Regional Board's 2006 Annual Report. Actual results.

Response G2:

Atlantic Richfield was unsure of the values U.S. EPA provided in Table 1 (Comment G2) for Phase IIA, and revisited the data source in the ICT Report (Appendix C). Atlantic Richfield identified corrections to the values for Phase IIA (highlighted below), which show that Phase IIA actually contained more concentrated water with higher acidity and sulfate concentrations than the May 2006 spring season influent water.

Atlantic Richfield also has questions regarding the values U.S. EPA provided in Table 1 for May 2006. Atlantic Richfield reviewed the Year-End Report for the 2006 Field Season, Appendix C, dated January 2007, prepared by the LRWQCB. Atlantic Richfield identified different maximum values measured during May 2006 for a number of the constituents (highlighted below), which were all lower than the values the U.S. EPA presented. If U.S. EPA has additional data sources other than Appendix C of the Year-End Report for the 2006 Field Season, please provide them to Atlantic Richfield, or please clarify the data source/methods resulting in those values.

The revised comparison shows that the Upper Ponds contain slightly higher acidity, total iron, and ferrous iron than the water Atlantic Richfield evaluated as part of the 85^{th} percentile shortened treatment scenario; however, Atlantic Richfield evaluated treating the water at a significantly higher flow rate than what occurred in May 2006 (143 gpm compared to 54 gpm). This indicates that the HDS Treatment Plant could treat the water observed during May 2006. In addition, as noted above, the contingency treatment system would still be available as a backup system.

Overall, the lack of early season pond water data is a data gap that Atlantic Richfield intends to address during the ICT Demonstration by performing pond water monitoring and sampling to further inform the full-scale ICT operations and the FS in support of evaluating final remedies.

Table 1: Revised Comparison of Expected Chemical Conditions

	Phase IIA[1]	Phase IIB[2]	85^{th} shortened[3]	May 2006[4]
Acidity	5,300	3,800	2,900	3,711[5]
Dissolved total Fe (mg/L)	650	490	610	640[6]
Ferrous Fe (mg/L)	Not Available	20	480	580[7]
Sulfate (mg/L)	7,100	5,300	3,300	Not Available
Influent Flow (gpm)	Not Applicable	Not Applicable	143	54[8]
Sludge Recycle rate (gpm)	Not Applicable	Not Applicable	35	Not Applicable

Notes:
1 = From Table 10 of Attachment C of Atlantic Richfield's ICT Report; dated December 18, 2015.
2 = From Table 11 of Attachment C of Atlantic Richfield's ICT Report; dated December 18, 2015.
3 = Table 6 and 7 of Atlantic Richfield's ICT Report; dated December 18, 2015; calculated by Atlantic Richfield; per an 85 th percentile water year.

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		4 = From Appendix C of LRWQCB's 2006 Year-End Report, dated January 2007. Maximum measured values during the month of May 2006 are presented. 5 = From Appendix C of Appendix C of LRWQCB's 2006 Year-End Report, dated January 2007. This is the maximum acidity measured from the siphon line (which pulled water from below the pond surface). The maximum acidity from the overflow line (pulling water from the pon d surface) was 1,309 mg/L. 6 = From Appendix D of Appendix C of LRWQCB's 2006 Year-End Report, dated January 2007. 7 = In Appendix C of LRWQCB's 2006 Year-End Report, dated January 2007, measured values of ferrous iron are not provided; however, it is estimated that during initial treatment, approximately 90% of the dissolved Fe is in the ferrous state. It is also noted th at stratification in the ponds had occurred, and that after the ponds had mixed and allowed to oxidize, the ponds contained iron mainly in a ferric state. 8 = Approximate average discharge during the month of May in 2006 from Figure 3 -1 of Appendix C of LRWQCB's 2006 Year-End Report, dated January 2007.

Comment #	U.S. EPA Specific Comments on Atlantic Richfield Company's Interim Combined Acid Drainage Treatability Investigation Report, Leviathan Mine Site, Alpine County, California, Dated December 18, 2015	Response
S1	**Volume of Water.** The volume of water seems to be underestimated. EPA does not agree that ARC's system designed to accommodate flows only through the 85th percentile water year, (which ensures a 15% failure rate) is sufficient for representing future design. Please review, revise and provide supporting documentation of the anticipated volume of water for treatment. ARC's 85th percentile water year underestimates the volume of water to be reasonably expected. ARC's report anticipates a maximum treatment volume of 27.2 million gallons (Mgal). Whereas, 31.8 Mgal of water were treated during 2011 and 24.4 Mgal of water were treated during 2006 without capture and treatment of the DS. With collection of the DS, it is likely that the ARC's proposal would have failed to treat some of the acid drainage during 2006. Therefore, use of the HDS Plant to treat the combined flows would result in a known failure rate of at least 2 out of 15 years, or 13 percent. Please review, revise and provide supporting documentation of a treatment system that can support the anticipated volume of water capacity during wet years.	U.S. EPA seems to misunderstand the intent of the ICT Treatability Investigation. Atlantic Richfield is not proposing an interim remedy with a "15% failure rate." It is only proposing to evaluate the feasibility of operating the HDS Treatment System to treat the quantity and quality of collected AD expected during an 85th percentile year. Again, Atlantic Richfield is not proposing that EPA select the HDS Treatment System now as the preferred remedial action for addressing all combined AD discharges at the Site. We are simply trying to evaluate the feasibility of using the HDS Treatment System to treat combined AD flows under prescribed conditions. If more AD is collected at the site during the pre-remedy period than can be handled by the HDS Treatment System, other contingency systems will be available to treat the excess. This is no different than the current approach by the LRWQCB. In 2006 and 2011, two treatment systems were utilized, the RCTS for early season treatment, and the PWTS for normal season treatment. For full-scale ICT, the HDS Treatment System, the contingency treatment system will be available for both early and normal season treatment, providing increased capacity over what is currently available. The Pond 1 Treatment System may also be available for normal season treatment. Additional evaluations performed as part of the FS and documented in the FS report will address the capture and treatment requirements needed for the full range of anticipated flow rates. The ICT Demonstration described in the ICT Report will support that more comprehensive analysis; but again, it is not intended to provide all of the needed information under all potential flow scenarios.
S2	**Treatment Period.** Please revise the assumptions for the treatment period necessary to ensure there is no discharge of untreated acid drainage. ARC's report assumes the spring season treatment period begins on May 1st. However, treatment start times have varied. Start times for 2005, 2006, and 2011 were late May, April 14 (the ponds spilled), and April 5 respectively. Start times are driven by the need to ensure that water from Ponds 1, 2N and 2S are treated to prevent a discharge of untreated acid drainage. It is likely that an early to mid-April treatment start date will be necessary at least 13% of the time. See comment S1 above. ARC's ability to achieve their stated goal of 90% up-time during early to mid-April conditions is questionable given the history of poor site access during April, and the likelihood the system will need to operate under low temperature conditions. Typically, ARC has stopped treatment at the HDS plant no later than mid-November. Historically, the mean temperatures at Monitor Pass are similar in April and November. Thus, the ability to continuously operate the HDS Plant through April and into early May is doubtful. Low temperatures have been cited by ARC as posing a threat of significant damage to the HDS Plant, and as rendering reliable capture of the CUD and DS impractical. Please provide a more complete evaluation of the treatment period and ensure that the use of the HDS	**Treatment Period:** Under current (pre-remedy) conditions, collection and treatment of acid drainage from the CUD and DS is only required from June 1 through September 30 for the reasons stated in the AOC and MRAM. Treatment of water in the Upper Ponds typically occurs during mid-to-late summer, unless emergency spring treatment is necessary earlier. The ICT Report selected the extended May 1 through October 31 treatment period and 85th percentile water year as the reasonably anticipated treatment scenario in order to gather data as to the feasibility of operating the HDS Treatment Plant to treat combined AD under higher flow rates. Again, this information will be used for screening remedial alternatives in the FS. However, Atlantic Richfield recognizes that earlier season treatment (prior to May 1) may occur. Similar to 2006 and 2011, in the event the Upper Ponds require early season treatment, a contingency treatment system will be available to prevent unwanted AD discharge from the Upper Ponds. The HDS Treatment Plant will also be available to provide additional treatment capacity. In 2006, between April 19 and July 7, and in 2011, between April 5 and May 31, the LRWQCB successfully achieved 100% uptime utilizing a contingency treatment system (the RCTS). The LRWQCB demonstrated that a contingency treatment system can achieve full uptime, even during poor site access conditions. As documented in the ICT Report, the HDS Treatment plant has historically maintained over 90% uptime, which included

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	plant alone, will prevent discharge of untreated pond water during an 85th percentile or wetter year. Given that the data collected from this on-going pilot treatability study is anticipated for use in the Feasibility Study and selection of alternatives. Please provide a review, study, and explanation that ensures anticipated ARAR's will be met. i.e. no releases that cause an exceedance of the Basin Plan for Leviathan creek.	shoulder season cold weather (May/November) conditions. HDS Treatment Plant start dates have included May 1, 2010, May 5, 2011, May 4, 2012, and May 10, 2013. Mobilization to the site and commencement of capture and conveyance at the CUD and DS typically has occurred in early to mid-April in recent years, even when relatively low water levels in Pond 4 meant that an early-May treatment system start date was not necessary. This demonstrates the ability to reach the site and operate the HDS Treatment Plant in early season conditions. The HDS Treatment Plant and the Capture and Conveyance System have also demonstrated the ability to operate in temperatures ranging from 20° to 30° F during the shoulder season and have freeze protection mitigations (e.g., heat traced/heated and insulated). Additionally, Atlantic Richfield will perform further evaluation of cold weather operations as part of the FS. The ICT Report concluded that the HDS Treatment Plant alone will be able to treat all flows during an 85th percentile year while preventing unwanted discharge of AD; however, for wetter years, similar to current operations, the contingency treatment system would also be utilized to prevent discharge of untreated pond water. Evaluating the HDS Treatment Plant alone for wetter years does not further inform the FS at this time, because during the FS evaluation, potential increased flows and more concentrated water may be evaluated in conjunction with other potential remedial alternatives. Source water reduction, longer treatment periods or year round treatment, and increased pond capacity are among some of the potential remedial alternatives, which may alleviate HDS Treatment Plant sizing concerns following final remedy selection. During the early response actions, effluent from the treatment systems is required to meet the discharge criteria specified in the MRAM. ARAR's for the final selected remedy will be identified during the FS. Performance monitoring results collected during the ICT treatability investigation, including the 2017 ICT field demonstration, will be evaluated in the context of the ARAR's identification process.
S3	**Operation Time during the Treatment Period.** ARC's data indicates that the HDS treatment plant would need to function continuously for at least 90 percent of the treatment period (90% up time). The HDS Plant has achieved 90 percent or more up time since 2008; however, there was adequate storage within Pond 4 to continue to receive and store captured water while the HDS plant was not discharging (i.e. because of low influent flows, or other various process alarm conditions). Further, it is important to note, that the high operation times occurred under low to average flow conditions with relatively dilute waters from the CUD and DS. ARC's treatability study focuses on treatment of pond water chemistry from July and August of 2006 ***after*** blending with CUD and DS waters. ARC must consider and analyze data from a wet year in April or May, when the influent water contains significantly more acidity, dissolved total iron, ferrous iron, and sulfate. To fully assess, it is essential that ARC's analysis assume influent flows will be at their highest and there will be no available excess storage capacity in the pond system. Under these conditions, operation times over the treatment period may be limited by scaling and lime consumption needs. ○ **Scaling.** EPA notes that ARC's Phase IIB treatability study encountered downtime due to scaling issues. As noted above, when the pond water during April / May has elevated ferrous iron (at least 400 times the concentration used in Phase IIA) it will dramatically increase the associated scaling issues. Please provide additional detail and revise to ensure that the HDS plant will achieve the necessary 90 percent operation time; particularly during April and May of a wet year. Given that the data collected from this on-going pilot treatability study is anticipated for use in the Feasibility Study and selection of alternatives; the design requirements should be such that ARAR's will be met. i.e. no releases that cause an exceedance of the Basin Plan for Leviathan creek.	**Operation Time during the Treatment Period:** The greater than 90% uptime the HDS Treatment Plant historically has achieved includes all unintended or required shutdowns due to maintenance or mechanical/ operational issues, and the associated time for corrections until normal operations could be resumed. In the event a process alarm shut down the HDS Treatment Plant, that time counted as a shutdown and was included as downtime. Atlantic Richfield recognizes that the water chemistry of CUD/DS is significantly less concentrated than that anticipated during full-scale ICT. One of the goals of the ICT Demonstration in 2017 is to confirm that the HDS Treatment Plant can maintain 90% uptime while treating concentrated combined water at high flows under full-scale field conditions. In Amec Foster Wheeler's experience, similar HDS Treatment Plants often have more than 90% uptime while operating at full capacity. It should also be noted that during emergency treatment, as presented in Table 1 above, the water contained in the Upper Ponds is not significantly more concentrated than the water Atlantic Richfield evaluated for the 85th percentile treatment scenario. While the AD discharging directly from the Pit Underdrain (PUD) and Adit may be more concentrated, the water contained in the Upper Ponds is diluted by direct precipitation and melting ice/snow. Because the Upper Ponds stratify in the winter, in the past, the highly dilute water rests on top while the more concentrated water sits below. This was observed in 2006, as shown in Table 1 above, where the Siphon Line (3,711 mg/L acidity) pulling from below the pond surface had a higher acidity than the overflow line (1,309 mg/L acidity) which was receiving water at the pond surface. When considering both the dilute upper layer and concentrated bottom layer, the overall influent acidity may even be lower than what Atlantic Richfield evaluated in the ICT Report. Atlantic Richfield believes the early season pond water chemistry (including stratification) is a data gap which will be addressed through early season pond water monitoring and sampling as part of the ICT Demonstration in 2017.

Comment #	U.S. EPA Specific Comments on Atlantic Richfield Company's Interim Combined Acid Drainage Treatability Investigation Report, Leviathan Mine Site, Alpine County, California, Dated December 18, 2015	Response
	○ **Lime Consumption:** EPA notes that ARC's Phase IIA treatability study was abandoned when it encountered a greater than expected lime demand. The influent (59% Pond 2S water and 41% Pond 4 water) was closest to (and more dilute than) the high acidity and high ferrous iron water treated from the upper ponds during 2006. It should be noted that if the pilot could not handle this mix, it is likely it would not handle the upper pond water during a wet year--which is more highly contaminated. Particularly, when the pond water during April / May has elevated concentrations and volumes, there will be a large increase in lime consumption. Please provide additional detail and revise to ensure that the HDS plant will achieve the necessary operation time; particularly during April and May of a wet year. Given that the data collected from this on-going pilot treatability study is anticipated for use in the Feasibility Study and selection of alternatives; assumptions should be sufficient to ensure that ARAR's will be met. i.e. meet water basin standards at all times	While AD flows are at their highest during the early season, in 2006, the RCTS prevented the Upper Ponds from discharging untreated AD in May by operating at approximately 54 gpm, which is less than 40% of the 143 gpm HDS Treatment Plant capacity presented in the ICT Report. Similar to 2006 and 2011, in the event the Upper Ponds require early season treatment, a contingency treatment system will be available to prevent unwanted AD discharge from the Upper Ponds, and the HDS Treatment Plant will also be available to provide additional treatment capacity. **Scaling:** Downtime due to scaling encountered during the pilot test was primarily caused by the limitations of the mobile pilot-plant, and do not reflect on the full-size HDS Treatment Plant. For example, downtime caused by clogging in the small diameter (1-inch) of the pilot-plant's lime/sludge mix tank's outlet. Due to its relative size, the outlet (6-inch diameter) of the existing HDS Treatment Plant's lime/sludge mix tank will be less prone to clogging. The ICT Report also concluded the scaling rates observed in the pilot-plant were manageable for full-scale ICT operations. Additionally, there were many optional modifications presented in the ICT Report to facilitate O&M activities during full-scale ICT, specifically to address potential scale accumulation, including: ● Install a manhole in the existing Clarifier to provide access for scale removal ● Improve access to the existing Lime/Sludge Mix Tank for sludge/scale removal ● Install flexible piping in place of the existing Reactor Tank overflow pipe (to the Clarifier) and the Clarifier overflow pipe (to the Effluent Tank) ● Relocate the discharge piping from the Effluent Tank to Leviathan Creek such that it is aboveground in order to improve accessibility for cleaning and maintenance (e.g., scale removal) ● Develop an O&M plan for managing scale in/on HDS Treatment Plant equipment and pipelines These optional modifications will be evaluated as part of the ICT Demonstration, and may be implemented prior to or during full-scale ICT operations. During the pilot-plant Phase IIB testing, water was treated with a low ferrous concentration (approximately 20 mg/L of ferrous in our influent water, compared to approximately 490 mg/L of total dissolved iron in our influent water) because the water naturally oxidized in the Upper Ponds prior to commencement of the test. Very limited early season pond water ferrous concentration data is available, and the estimates from Table 1 above indicate the early season ferrous concentrations are approximately 30 times (not 400 times) higher than the water tested during Phase IIB. However, a high ferrous iron concentration is not anticipated to increase the scaling potential of the water. The primary issue with a high ferrous concentration is the ability of the HDS Treatment plant to convert the ferrous iron to ferric iron. As documented in the ICT Report, the hydraulic retention time of the Reactor Tank and blower capacity are both sufficient to convert the ferrous iron to ferric iron. High ferrous concentrations are only anticipated to be encountered during early season treatment, where the contingency treatment system will also be available to meet additional treatment demand, if needed. Atlantic Richfield believes the early season pond water chemistry (including ferrous concentrations) is a data gap which will be addressed through early season pond water monitoring and sampling as part of the ICT Demonstration in 2017. Treating water with a higher ferrous concentration by the HDS Treatment Plant is another data gap that may be addressed during the ICT Demonstration, depending on available pond water chemistry. **Lime Consumption:** Phase II initially was planned to treat a blend of acid drainage to achieve a target lime utilization rate of approximately of 1.5 g/L. However, a jar neutralization test conducted on the initial blending ratio of 41% Pond4 water

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		and 59% Pond 2S water indicated that the blend would have a higher than desired lime utilization rate (4.9 g/L as opposed to 1.5 g/L) due to the evapo-concentrated water in Pond 2S. Therefore, the test was momentarily halted and the blend ratio was re-evaluated. It should be noted that metals concentrations in the water treated during Phase IIA by the pilot-plant were below the average MRAM discharge criteria except for Al, which was slightly above the average discharge limit of 2.0 mg/L but below the maximum MRAM discharge criterion of 4 mg/L. It is likely that the Al limit could have been met had the pH setpoint been 8.0 instead of 8.5. Following the blend-ratio evaluation, a blend of 60% Pond 4 and 40% Pond 2S water (lime utilization rate of 2.7 g/L at pH setpoint 8.0) was selected for Phase IIB by evaluating the total volume of Pond 2S water and Pond 4 water for the 2014 drought interim treatment season. Additionally, the Phase IIB blend had similar water chemistry to that provided by the LRWQCB for Upper Pond water sampled in July and August 2006. It should also be noted that the Upper Pond water sampled in July and August 2006 had been impacted during early season emergency treatment (e.g., less acidic water was stratified and treated first) and was evapo-concentrated, which resulted in elevated metals loading, sulfate concentrations, and lime utilization rates. As documented in the ICT Report, only minor equipment modifications are needed to meet the lime dosing requirements to treat the discharge conditions reasonably anticipated to occur during the interim period. To address situations where additional treatment capacity is needed, a contingency treatment system would be available to meet the additional demand *See* Atlantic Richfield's response to Comment S2 regarding the topic of ARAR's.
S4	**Hydraulic Retention Time** Please provide additional detail and supporting documentation to ensure successful treatment using a flow rate of 138 gpm and a residence time of 45 minutes. Section 6.2.1 states that a 30-minute retention time is recommended for adequate lime neutralization. Successful treatment is also contingent on oxidation of the ferrous iron. If the iron is not completely oxidized, an increased residence time would likely be necessary to successfully treat the water. Using the influent ferrous iron concentrations encountered during 2006, a constant aeration volume of 34 cfm is needed to ensure oxidation of the ferrous iron alone. The significantly higher ferrous iron concentrations are expected to require an increased hydraulic retention time during a period of high flow. The excess acidity created by the oxidation and precipitation of the ferrous iron will also increase the lime demand. Please modify the report to assume an increased retention time to ensure: oxidation of the ferrous iron, time for neutralization to occur, and increased settling time required to remove the increased quantity of precipitates. Please provide additional detail and supporting documentation to ensure successful treatment using a flow rate of 138 gpm and a residence time of 45 minutes during treatment of Adit and PUD water similar to the water treated during spring of 2006.	Section 6.2.3 and Section 6.2.4 in the ICT Report address requirements for ferrous iron oxidation, including evaluating the time and amount of oxygen required for ferrous to oxidize. At the theoretical 138 gpm flow rate, the residence time in the Reactor Tank would be 46 minutes which is sufficient to convert ferrous iron to ferric. Using the estimated ferrous concentration of 580 mg/L presented in Table 1 above from May 2006, the blowers would require 29 SCFM capacity, and the current capacity of the blowers is 40 SCFM, which is also sufficient to convert the ferrous iron to ferric. High ferrous concentrations are only anticipated to be encountered during early season treatment, where the contingency treatment system will also be available to meet additional treatment demand.
S5	**Contingency Plans** The text in Section 5.3 notes that contingencies might be necessary. Please include a full description of specific and implementable alternatives to back up the ICT. For example, what is the contingency if the ICT does not provide adequate treatment capacity to prevent discharge of pond water. A contingency measure is necessary to prevent discharge of untreated mine drainage during the spring season peak flows, particularly in wet water years similar to 2006 and 2011. i.e. Rotating Cylinder Treatment System has been used to successfully treat the upper pond water during prior wet years.	We recognize that a contingency measure may be necessary to prevent untreated discharges from the Upper Ponds during a "wet" year. Atlantic Richfield will use information collected from past early season treatment successes when evaluating the future contingency treatment system. Atlantic Richfield also plans to improve upon the previous contingency treatment system methods by installing the contingency treatment on-site, such that it will be readily available for commissioning and operation by the LRWQCB to facilitate rapid startup and operations, and the contingency treatment system will be sized to meet the demand of early season flows and water chemistry.

TABLE 1
RESPONSE TO U.S. EPA COMMENTS DATED DECEMBER 21, 2016
Leviathan Mine Site
Alpine County, California

Comment #	U.S. EPA Specific Comments on Atlantic Richfield Company's Interim Combined Acid Drainage Treatability Investigation Report, Leviathan Mine Site, Alpine County, California, Dated December 18, 2015	Response
S6	**System Wide Scale Accumulation.** ARC assessed scale accumulation for the reactor tank, clarifier, and lime/sludge mix tank. Section 6.7 also describes possible remedies for occurrence of scale at the reactor overflow pipe, clarifier overflow pipe, during sludge handling, and discharge piping to Leviathan Creek. During seasonal HDS operation scale has also been encountered in conveyance pipes. For example: at the CUD, Pond 4, and the HDS intake. The proposed ICT will contain at least ten times more ferrous iron, aluminum, sulfate, and acidity than water treated during recent years. Therefore, ARC must provide a full evaluation of the scaling potential, including an assessment of the conveyance and HDS intake. Please also identify steps necessary to ensure that accumulation of scale does not interfere with treatment operation. See also Comment S2 above.	A limited scaling evaluation was performed during bench-scale testing presented in Appendix B of the ICT Report, which concluded that scaling for concentrated blends was likely. As discussed in response to comment S3, there were many optional modifications presented in the ICT Report to facilitate O&M activities during full-scale ICT, specifically to address potential scale accumulation, including developing an O&M plan for managing scale in/on HDS Treatment Plant equipment and pipelines. The ICT Demonstration will provide additional information and assist with evaluation of scale accumulation in the Upper Pond Conveyance System and HDS Treatment Plant influent pipelines. These optional modifications will be evaluated as part of the ICT Demonstration, and may be implemented prior to or during full-scale ICT operations.
S7	**Schedule:** Please provide a schedule that incorporates this work into the final and complete RI/FS schedule/ Gannt Chart. EPA provides comments on the RI/FS schedule under separate cover. This ICT work should be completed sufficiently in time to provide information necessary to complete the RI/FS per the EPA approved schedule. EPA is not opposed to work for refining the proposed or selected long term remedy.	A schedule for ICT implementation is presented below. This will be incorporated into the overall RI/FS schedule/Gantt Chart. - First Quarter 2017 – Submit the Interim Combined Acid Drainage Treatability Investigation Work Plan Amendment No. 2 – Full Scale Field Demonstration to US EPA for review and approval. - Spring/Summer 2017 (depending on snow accumulation and weather) – Conduct full-scale ICT Field Demonstration. A Detailed schedule for testing in the spring 2017 will be developed and adjusted as necessary in early 2017 depending on the severity of the winter and the volume and chemistry of water in the Upper Ponds. - Fall/Winter 2017 – Prepare and submit to the U.S. EPA an ICT Demonstration Summary Memorandum documenting the ICT Demonstration activities, results, and proposed schedule for subsequent full-scale ICT activities, including seeking US EPA AOC/AAA order modification and approval to implement full-scale ICT operations. - Spring/Early Summer 2018 – Installation of a contingency treatment system. - Early Summer 2018 – Initiate full-scale ICT under modified AOC/AAA.